

## ■ Initial context

The academic and research *Urban Mines Chair* was created in 2014 by ecosystem, in partnership with the ParisTech Foundation and three French engineering schools, including the *École Nationale Supérieure d'Arts et Métiers*.

Within the scope of this Chair, discussions between academic structures and industrial stakeholders on the side of ecosystem have been conducted. More specifically, during workshops on specific themes the need of a new standard for recycled plastics has been highlighted. The goal of this standard is to propose the definition of a new material quality grade for these plastics.

This course of action is included in the scope of a doctorate thesis, financed by the Urban Mines Chair, on the eco-design of electric and electronic equipment by integrating recycled plastics from WEEE.

The objective of this work is to convey satisfying data on the characteristics of a recycled plastic, while respecting the balance between what can be provided by the plastics regenerators<sup>1</sup>, and the data requirements from the producers of plastics and EEE products.

Research towards a normalized communication tool between regenerators and recycled plastics users lead to the construction of a technical data sheet, that aims at facilitating information transfer, and gathering information on the demands from both parties.

This sheet allows for the regenerators to fill in all the technical parameters necessary to provide a good definition of the quality of the recycled plastic batch.

## ■ Construction of the datasheet

This technical datasheet being a communication tool between actors from the field of recycled plastics, the first objective was to find an agreement on its content.

To do so, several workshops have been put in place, between ENSAM, ecosystem, regenerators, and recycled plastics users. On that occasion, the datasheet was named "Technical sheet for recycled plastic materials"

Several surveys have been conducted in order to identify the most relevant data to obtain on a recycled plastic batch. The results allowed us to weight each parameter listed in the sheet.

The goal of the weighting is to highlight the regenerator's efforts in filling in the most important data. An indicator is then calculated by the sheet, which indicates its filling rate. Indeed, this tool does not aim at evaluating the quality of the material, but the completeness of the submitted data.

Thereby, the technical sheet for recycled plastic materials was consolidated with the participation of 15 producers and 10 regenerators and recycling companies, all of whom expressed their enthusiasm for this communication tool.

The regenerators are satisfied with this format, they could potentially use it to promote the use of recycled plastics to producers of plastics and EEE products. As for the latter, they appreciate the clarity that this sheet could have, as it lists a large amount of information on a recycled plastic batch.

## ■ Identified parameters

Firstly, the properties of a recycled plastic were listed, and distributed among 9 categories:

- *Product description* gathers commercial data on the batch;
- *Composition* lists the constituent elements of the recycled plastic batch;
- *The functional and technical properties of the batch*;
- *The injection process data* for this plastic batch;
- *Data on the material traceability and recycling processes* performed on the batch.
- *The compliance to the regulation* ensures that the batch meets the requirements of several directives (e.g. REACH) or norms (e.g. Halogen Free);
- *The quality management* category lists the technical specification documents available from the regenerator, in addition to this sheet;

- The logistics category addresses practical sales aspects, like the available supply, or the storage conditions of the plastic;
- The environmental aspects regarding this plastic batch;

In total, 76 parameters have been identified and classified, all of which are associated with measurement methods and norms.

#### ■ The different formats

Three versions of the sheet have been built :

- A generic version, which only contains parameters that have been regarded as the most important and proposes a printable summary of the sheet.
- An utter version (all the parameters are included) which aims at being filled in as much as possible by the regenerator, in order to provide a catalogue that can be made available to recycled plastics users;
- An exchange version, which includes all parameters, along with a column «User requirements», allowing the recipient of the sheet to specify which parameters they are interested in. This version is built to go through multiple cycles between the regenerator and the user, to propose the most adequate definition of the plastic batch.

These versions can therefore be adapted to the needs of the different stakeholders, and are at their disposal.

#### ■ Next steps

This sheet highlights the inherent mechanical, chemical and functional properties of a recycled plastic batch. But it would be even

more useful if it helped the plastics users to choose between several recycled resins.

Therefore, it seems interesting to use the data collected by this tool as a base to build an interactive database. However, in order to actually build this database, we need the help of other organisms.

Under the supervision of ecosystem, discussions have been initiated between the doctorate student and two organisms that already have created material databases. The goal of these discussions is to compare the information listed in the technical sheet for recycled plastic materials with the parameters listed in existing databases. The overall objective of this approach being an exchange of knowledge on the identified parameters that are required to define a material quality grade, thus allowing us to build a material quality standard for recycled plastics.

The use of the technical sheet for recycled plastic materials is ruled by a Creative Commons licence. We chose this approach so that the sheet can be made available in open source, allowing any stakeholder to use or take their inspiration from this tool and meet the ultimate goal of this work : facilitate and improve the interactions between regenerators and recycled plastic material users.

The technical sheets are available for download following this link :

#### RPM Technical Sheets

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<sup>1</sup> : In this article, the regenerator is the stakeholder that transforms plastic waste into flakes or plastic granules of a specific recycled resin. Depending on the cases, regenerators are more or less involved in the anterior phases of WEEE recycling.